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Illness Perception, Treatment Adherence and Coping in Persons with Coronary Artery Disease Undergoing Angioplasty

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Abstract

Background and Objective: Coronary artery disease (CAD) is the leading cause of sudden death. In this article, we compared patients' illness perception (IP), treatment adherence and coping mechanisms of patients undergoing percutaneous transluminal coronary angioplasty (PTCA). Methods: In this descriptive, prospective observational study IP, treatment adherence and coping of 140 patients were evaluated pre-PTCA, at the time of hospital discharge and 1 to 3 months post-PTCA by Illness Perception Questionnaire, Morisky Treatment Adherence and Carver's brief COPE questionnaires. Results: 1 - 3 months post-PTCA, all dimensions of IP changed significantly except personal and treatment control. Adherence scores decreased simultaneously. With respect to coping mechanisms, all increased except behavioral disengagement, emotional support, instrumental support and religion which decreased significantly post-PTCA. Conclusions: In Overall, an improved IP and increased use of controllable causal attributions led to an increase in medication adherence and adaptive coping strategies. Post-treatment health behaviors are predictable by assessing patients' illness-related beliefs beforehand.

Keywords

Illness Perception, Adherence, Coping, Percutaneous Transluminal Coronary Angioplasty (PTCA), Coronary Artery Disease (CAD)

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1. Introduction

Coronary artery disease (CAD) is the leading cause of sudden death in the Iranian population [1] and worldwide [2]. Treatment of CAD includes medical treatment, percutaneous transluminal coronary angioplasty (PTCA) and coronary artery bypass graft [3], the most common of which is PTCA [4] [5]. An individual's illness perception (IP) is their belief and expectation about the illness and is a major factor predicting their active engagement in therapy, and resulting outcomes. IP influences individuals' emotional responses to illness and their coping behavior, such as adherence to treatment [6] [7]. It is central to Self-Regulation Theory, which postulates that IP determines a person's appraisal of an illness situation and health behavior [4] [8]. According to the common-sense model of illness, patients respond to illness by forming cognitive and emotional representations of illness that influence their coping and health behavior, such as adherence [9]. Cognitive representations determine patients' emotional responses and their effort for adaptation to illness [10].

To date, studies about IP of patients undergoing PTCA have focused on patients' perceptions on a superficial level [4], or surveyed IP in a single phase only [11]. In addition, previous studies have not considered the relationship between IP and health behaviors. The aim of this study is to compare IP dimensions thoroughly, contrary to previous ones, treatment adherence and coping mechanisms of patients with CAD, before and after they undergo PTCA.

2. Methods

2.1. Study Design

Data were collected for this descriptive, prospective observational study between January and July 2015. Patients admitted to the ward one day prior to elective PTCA and who met the inclusion criteria were invited to participate in the study. Following receipt of informed consent and prior to PTCA, participants completed a questionnaire package which at the initial data collection time-point also included a demographic questionnaire. Additional information regarding medical history, number of diseased coronary vessels, stent deployment and whether or not PTCA was successful, was extracted from medical records. Participants completed the same questionnaire package post PTCA (at discharge) and one or three months later (at the cardiologist's office or heart clinic). The study conformed to the principles outlined in the Declaration of Helsinki and was approved by the ethics committee of the University of Medical Sciences (5/4/828).

2.2. Sample

A total of 155 patients who met the study inclusion criteria were selected by convenience sampling. Patients were approached and provided with written and verbal information about the study. Patients were deemed eligible for inclusion if they: had a confirmed angiographic diagnosis of coronary heart disease and were waiting for elective PTCA with or without stent insertion, were more than 18 years of age and, were willing to participate in the study. Participants were excluded from the study if they had a history of a psychiatric disorder, major medical problems such as cancer, chronic renal failure, etc. or if their PTCA was unsuccessful. The sample size was calculated by the pilot study with G Power software (v 3.1.4; Heinrich-Heine-Universität Düsseldorf).

2.3. Data Collection Instruments

The following instruments were used to collect data at three time-points: pre-PTCA, post PTCA at discharge and post-PTCA 1 or 3 months later. Content validity of the questionnaires was confirmed using feedback from expert nurses', cardiologists' and psychologists'. All three instruments have been described as demonstrating good levels of both internal consistency (Cronbach's alpha) and consistency (test–retest reliability); reliability coefficients for the questionnaires were >0.78.

The revised illness perception questionnaire (*IPQ-R*). IP, as the main domain of the self-regulation model formulated by Leventhal *et al*. (1980), consists of eight components which includes: (a) disease identity (the name and symptoms that the patient identifies as part of the illness); (b) timeline (how long the patient thinks it will last); (c) perceived consequences of the illness on the patient's life; (d) the amount of control the patient perceives they have over the illness; (e) causal attribution (the cause of the illness) [4] [9]; (f) illness coherence (how well the patient feels they understand the illness); (g) perception of treatment control (how much treatment can help to control the illness) and (h) the emotional representations (how much patients are emotionally af-

fected by the illness) [9]. IP not only determines coping responses, but is also directly related to outcomes such as treatment adherence. Patients set their IP as a basis for coping with illness according to Leventhal's *et al*. (1980) theory [12]. In order to prevent the reappearance of symptoms, even after treatment, coping with the illness and adhering to medical advice is essential [13].

IPQ-R [14] was used for this study as it assesses all dimensions of patients' IPs and beliefs surrounding their illness. The first part surveyed Identity and is presented in a yes-no format. The sum of the yes-rated symptoms in column two formed the illness identity subscale. High scores in this section represent strongly held beliefs about the number of symptoms attributed to the illness.

The second part of the questionnaire surveyed Timeline (acute/chronic), Consequences, Personal control, Treatment control, Illness coherence, Timeline cyclical and Emotional representations. These were rated on a 5-point Likert scale ranging from "strongly agree" to "strongly disagree". After reverse scoring appropriate items, all scale items were summed on each particular scale. High scores on the timeline, consequences, and cyclical dimensions represent strongly held beliefs about the chronicity of the condition and the negative consequences and cyclical nature of the condition. High scores on the personal control, treatment control and coherence dimensions represent positive beliefs about the controllability of the illness and a personal understanding of the condition. The final part of the questionnaire related to casual attribution. By recoding "strongly disagree" and "disagree" to 0 and "having no idea", "agree" and "strongly agree" to 1, the percentage of each item at all three sampling time-points were calculated using descriptive statistics.

Morisky medication adherence questionnaire (*MAQ*). MAQ [15] consists of eight yes-no items that evaluate treatment adherence to medications. Scores greater than 2 demonstrate low adherence, scores of 1 or 2 demonstrate medium adherence, while a score of 0 demonstrates high adherence.

Carver's brief COPE. The brief COPE instrument [16] was designed to explore the degree to which participants utilize specific coping strategies. The instrument consists of 28 items which are rated on a four-point likert scale, ranging from 1 = I usually don't do this at all, to 4 = I usually do this a lot. Coping strategies refer to the specific efforts, both behavioral and psychological, that people employ to master, tolerate, reduce, or minimize stressful events. Scales of coping strategies include: 1) self-distraction (employing strategies to divert concentration away from the condition); 2) active coping (exerting effort to remove or circumvent the stressor); 3) denial (attempt to reject the reality of the stressful event and consider how the stressor might be confronted); 4) substance use (use of alcohol and other drugs as a means of disengaging from the stressor); 5) use of emotional and instrumental support (obtaining sympathy or emotional support from someone and seeking assistance, information, or advice about what to do); 6) behavioral disengagement (giving up or withdrawing effort and the attempt to attain the goal with which the stressor is interfering); 7) venting (use of a concomitant tendency to ventilate or discharge those feelings); 8) positive reframing (changing one's view of a stressful situation in order to see it in a more positive light); 9) planning (planning one's active coping efforts); 10) humor (making jokes about the stressor); 11) acceptance (accepting the fact that the stressful event has occurred and is real); 12) religion (engaging in religious activities) and 13) self-blame (accounting him/herself culpable of the situation) [17] [16].

Two general coping strategies have been identified: (a) problem-solving strategies (efforts to do something active to alleviate these stressful circumstances and (b) emotion-focused coping strategies (involves efforts to regulate the emotional consequences of stressful or potentially stressful events). Both strategies are known as adaptive coping strategies. However, there is also a maladaptive strategy that is non-coping. This is known as avoidance (symptoms are reduced while maintaining strengthening the disorder in the short term such as behavioral disengagement). Several studies have indicated that people use all the aforementioned strategies to combat most stressful events [18] [19].

2.4. Data Analysis

Data were analyzed using SPSS version 13 by descriptive statistics, repeated measured ANOVA and Pearson correlations. Data are presented as means and standard deviations or frequencies and percentages. The level of significance was set at 0.05.

Findings

A total of 155 patients, scheduled for an elective PTCA, were recruited to the study over a seven-month period. Nine patients did not undergo PTCA as they opted for CABG or medical treatment, three refused to complete the questionnaire and three did not complete the follow-up questionnaires. From the remaining 140 participants, who comprised the study sample, 84 (60%) had stents inserted while 56 (40%) had PTCA with no stent

inserted. Less than one third of participants (n = 42) had previously experienced a cardiac event, while 25 had previously undergone PTCA (**Table 1**).

2.5. Illness Perception

Statistical analysis using repeated measures ANOVA with a Greenhouse-Geisser correction, revealed statistically significantly changes in Identity ($p < 0.001$), Timeline ($p < 0.001$), Consequences ($p = 0.015$), Illness coherence ($p = 0.007$), Timeline cyclical ($p < 0.001$) and Emotional response ($p < 0.001$). Conversely, changes in personal and treatment control were not statistically significant ($p > 0.05$). Post hoc tests using a Bonferroni correction revealed an insignificant increase ($p = 0.109$) in Identity from pre-PTCA to post PTCA at discharge (3.01 ± 1.93 vs. 3.22 ± 2.04). However, Identity increased significantly from pre-PTCA to post-PTCA 1 - 3 months later (3.58 ± 1.86) ($p = 0.002$) and from post-PTCA at discharge to post-PTCA 1 - 3 months later ($p = 0.024$).

There was an insignificant decrease ($p = 1.00$) in Timeline from pre-PTCA (16.42 ± 6.78) to post-PTCA at discharge (16.28 ± 6.40). When these results were compared with post-PTCA 1 - 3 months later (19.97 ± 6.35), Timeline increased significantly ($p < 0.001$).

With respect to Consequences, there was a sharp and significant increase from pre-PTCA to post-PTCA at discharge ($p = 0.003$), while changes post-PTCA at 1 - 3 months were not significant. Comparison between pre-PTCA and post-PTCA at discharge and post PTCA at 1 - 3 months were insignificant ($p = 0.21$ and $p = 1.00$ respectively) (**Table 2**).

Mean Illness Coherence scores increased significantly from pre-PTCA (16.06 ± 5.24) to post-PTCA at 1 - 3 months (17.46 ± 4.18) ($p = 0.013$).

There was a significant downward linear trend in mean scores of Timeline Cyclical from pre-PTCA (12.53 ± 3.52) to post PTCA at discharge (11.99 ± 3.21) and post-PTCA at 1 - 3 months (11.04 ± 3.84) ($p < 0.05$). Similarly, there was a statistically significant linear decrease in Emotional Representation mean scores from pre-PTCA (17.81 ± 5.30) to post-PTCA at discharge (17.29 ± 4.23) to post-PTCA at 1 - 3 months (16.25 ± 3.71) ($p < 0.05$).

Analyses of casual attribution demonstrated that past poor medical care, my negative mental attitude, overwork, my emotional state, alcohol, smoking/drugs and my personality scores remained unchanged statistically (**Table 3**). There was a gradual growth in mean Stress scores from pre-PTCA (3.23 ± 1.56) and post-PTCA at discharge (3.22 ± 1.64) to post-PTCA 1 - 3 months later (3.48 ± 1.33) with a statistically significant trend ($p < 0.05$) (**Table 3**). Mean Hereditary scores increased significantly across the three time points ($p < 0.05$), while mean scores of a germ or virus decreased significantly from pre-PTCA to post-PTCA at discharge and 1 - 3 months later ($p < 0.05$). Mean Diet scores changed steadily with a statistically significant upward linear trend over time from pre-PTCA to post-PTCA at discharge and 1 - 3 months later. The decrease in mean Chance or bad luck scores from pre-PTCA to post-PTCA was significant ($p = 0.008$). Environmental pollution mean scores

Table 1. Summary statistics for demographic characteristics of patients.

Characteristics of patients		% (n)
Age, mean ± SD (range)	61.01±10.7 (29-89)	
Gender	Male	52.9 (74)
	Female	47.1 (66)
Past hospital admission	Yes	60.7 (85)
	No	39.3 (55)
Past MI	Yes	30.0 (42)
	No	70.0 (98)
Past PTCA	Yes	17.9 (25)
	No	82.1 (115)
Type of angioplasty	With stent	60.0 (84)
	Without stent	40.0 (56)
Number of diseased vessel, mean ± SD (range)	2.06 ± 0.79 (1 - 3)	

Table 2. Summary statistics for illness perception dimensions, adherence and coping scales.

	Mean (SD)			F	p^a
	Pre-PTCA	Post-PTCA at discharge	Post-PTCA, 1-3 months later		
Identity	3.01 (1.93)	3.22 (2.04)	3.58 (1.86)	9.295	<0.001
Timeline	16.42 (6.78)	16.28 (6.40)	19.97 (6.35)	36.174	<0.001
Consequences	20.10 (4.30)	21.11 (3.60)	20.81 (3.57)	4.440	0.015
Personal Control	20.61 (6.13)	21.21 (5.31)	21.10 (5.11)	1.022	0.359
Treatment Control	19.66 (3.79)	20.16 (3.10)	20.01 (2.96)	1.353	0.259
Illness Coherence	16.06 (5.24)	16.51 (4.97)	17.46 (4.18)	5.154	0.007
Timeline Cyclical	12.53 (3.52)	11.99 (3.21)	11.04 (3.84)	11.222	<0.001
Emotional Representation	17.81 (5.30)	17.29 (4.23)	16.25 (3.71)	8.482	<0.001
Adherence	2.27 (1.68)	2.20 (1.59)	1.44 (0.89)	24.535	<0.001
Self-Distraction	5.83 (2.18)	5.48 (2.04)	6.21 (1.79)	7.871	0.001
Active Coping	6.03 (1.84)	6.18 (1.71)	7.06 (1.71)	16.200	<0.001
Denial	2.59 (0.93)	2.30 (0.71)	2.23 (0.63)	11.267	<0.001
Substance Use	2.16 (0.87)	2.06 (0.33)	2.19 (0.81)	4.047	0.030
Emotional Support	6.68 (1.35)	7.16 (1.24)	5.91 (1.45)	50.287	<0.001
Instrumental Support	6.58 (1.48)	7.21 (1.23)	5.99 (1.41)	38.506	<0.001
Behavioral Disengagement	3.03 (1.23)	2.66 (1.02)	2.54 (1.05)	12.567	<0.001
Venting	5.13 (1.45)	4.91 (1.09)	4.95 (0.75)	2.002	0.141
Positive Reframing	5.13 (1.58)	5.51 (1.68)	5.46 (1.63)	3.594	0.032
Planning	3.82 (1.91)	3.19 (1.50)	3.13 (1.32)	24.064	<0.001
Humor	3.52 (1.01)	3.63 (1.10)	3.97 (1.09)	10.151	<0.001
Acceptance	6.09 (1.36)	6.36 (1.13)	6.96 (1.03)	26.841	<0.001
Religion	6.68 (1.67)	6.53 (1.64)	6.38 (1.72)	4.050	0.023
Self-Blame	3.51 (1.52)	3.51 (1.52)	3.42 (1.51)	0.356	0.689

[a]*P*-value based on repeated measures ANOVA, Greenhouse-Geisser test.

Table 3. Summary statistics for casual belief of illness perception.

	Mean (SD)			F	P^a
	Pre-PTCA	Post-PTCA at discharge	Post-PTCA 1 - 3 months later		
Stress	3.23 (1.56)	3.22 (1.64)	3.48 (1.33)	7.467	0.001
Heredity	1.76 (1.22)	2.03 (1.22)	2.25 (1.31)	14.112	<0.001
Germ/virus	1.32 (0.58)	1.14 (0.41)	1.16 (0.47)	7.207	0.001
Diet	2.84 (1.67)	3.16 (1.61)	3.46 (1.35)	20.170	<0.001
Bad luck	1.86 (1.27)	1.70 (1.10)	1.58 (0.92967)	6.240	0.003
Past poor medical care	2.26 (1.56)	2.32 (1.47)	2.57 (1.45)	4.213	0.020
Environmental pollution	1.38 (0.90)	1.23 (0.57)	1.26 (0.53)	4.164	0.023
My own behavior	2.25 (1.41)	2.48 (1.50)	3.08 (1.38)	27.736	<0.001
My negative mental attitude	1.66 (1.02)	1.76 (1.06)	1.82 (1.11)	2.683	0.072
Family problems	3.03 (1.67)	3.23 (1.71)	3.36 (1.49)	5.939	0.004
Overwork	2.61 (1.68)	2.70 (1.66)	2.58 (1.58)	1.279	0.280
My emotional state	2.06 (1.43)	2.13 (1.44)	2.01 (1.24)	1.347	0.262
Aging	2.11 (1.50)	1.95 (1.41)	1.80 (1.25)	9.152	<0.001
Alcohol	1.04 (0.24)	1.00 (0.00)	1.03 (0.34)	1.168	0.301
Smoking/drugs	1.75 (1.42)	1.66 (1.35)	1.69 (1.44)	2.558	0.090
Accident/injury	1.20 (0.66)	1.13 (0.61)	1.11 (0.60)	10.610	<0.001
My personality	1.60 (0.99)	1.71 (1.21)	1.63 (1.20)	1.337	0.264
Altered immunity	1.62 (1.11)	1.43 (0.83)	1.33 (0.78)	12.374	<0.001

[a] *P*-value based on repeated measures ANOVA, Greenhouse-Geisser test.

decreased significantly from pre-PTCA to post-PTCA at discharge (p = 0.033). Mean scores of My own behavior increased significantly from pre-PTCA and post-PTCA at discharge to post-PTCA at 1 - 3 months (p < 0.001). The increasing mean scores of Family problems from pre-PTCA to post-PTCA at discharge (p = 0.030) in addition to 1 - 3 months later (p = 0.008) were significant. Mean scores of Aging decreased significantly from pre-PTCA to post-PTCA (p = 0.001).

Over time, mean scores of Accident or injury significantly decreased from pre-PTCA to post-PTCA at discharge (p = 0.004) and 1 - 3 months later (p = 0.002). Similarly, mean scores of Altered immunity significantly changed in a downward linear trend from pre-PTCA to post-PTCA at discharge (p = 0.010) and 1 - 3 months later (p < 0.001).

2.6. Adherence

Mean changes in adherence scores over time, from pre-PTCA and post-PTCA at discharge to post-PTCA 1 - 3 months later were statistically significantly ($p < 0.001$) (**Table 2**).

2.7. Coping

Self-distraction mean scores increased significantly from post-PTCA at discharge to 1 - 3 months later ($p = 0.001$) (**Table 2**). Active coping, humor and acceptance mean scores all showed an upward trend between pre-PTCA and post-PTCA at discharge to 1 - 3 months later ($p < 0.05$). Mean scores of denial and planning demonstrated a significant downward trend from pre-PTCA to post-PTCA at discharge ($p < 0.001$) to 1 - 3 months later ($p < 0.05$).

Mean substance use scores increased significantly from post-PTCA at discharge to 1 - 3 months later ($p = 0.019$). In addition, the use of emotional and instrumental support subscales, increased significantly from pre-PTCA to post-PTCA at discharge, while it decreased significantly from pre-PTCA to post-PTCA at 1 - 3 months and post-PTCA at discharge to 1 - 3 months later ($p < 0.001$).

There was a significant downward trend in mean scores of behavioral disengagement from pre-PTCA to post-PTCA at discharge ($p = 0.001$) and 1 - 3 months later ($p < 0.001$). Meanwhile, mean scores of positive reframing, increased significantly from pre-PTCA to post-PTCA at discharge ($p = 0.022$), while mean scores for religion significantly decreased from pre-PTCA to post-PTCA at 1 - 3 months ($p = 0.037$). Changes in venting and self-blame scores over time were non-significant.

3. Discussion

With the exception of personal control and treatment control, patients' IP dimensions changed significantly over time, in this observational study. Patients' adherence from pre-PTCA to post-PTCA at discharge remained unchanged while it increased from both pre-PTCA to post-PTCA at discharge to 1 - 3 months later. Meanwhile, increases in the following coping strategies were significant: self-distraction and substance use post-PTCA at discharge to 1 - 3 months later; active coping, humor and acceptance from pre-PTCA and post-PTCA at discharge to 1 - 3 months later and; positive reframing, emotional and instrumental support from pre-PTCA to post-PTCA at discharge.

Decreased scores in denial, planning and behavioral disengagement from pre-PTCA to post-PTCA at discharge and 1 - 3 months later; emotional and instrumental support from pre-PTCA and post-PTCA at discharge to 1 - 3 months later and religion from pre-PTCA to 1 - 3 months later were all significant, while venting and self-blame remained unchanged.

Increased mean score in Identity from pre-PTCA and post-PTCA at discharge to 1 - 3 months later revealed that participants experienced more symptoms 1 to 3 month's post-PTCA. This finding is inconsistent with those of Astin and Jones (2006), who reported PTCA to be an effective and curative procedure for CAD for subsiding identity scores [4]. The increase in identity scores may have occurred because patients consider PTCA to be a non-efficient treatment for their illness, just as Bowling *et al*. (2012) revealed negative attitudes toward angioplasty in their study [20].

Increased scores in Timeline from pre-PTCA and post-PTCA at discharge to 1 - 3 months later and a simultaneous decrease in Timeline cyclical scores revealed that patients believed in the chronicity of their condition contrary to pre-PTCA when they had misconceived CAD as an acute illness or one with cyclical nature. This may have resulted from an immediate relief of symptoms following PTCA. While misperceptions have im-

proved over time in this study, the reason for same is unclear. It may be due to attendance at rehabilitation clinics or follow-up sessions. These findings support those from a previous study [4] and are also consistent with studies which linked timeline misperception and poor adherence to health behaviors [21]-[23].

Increased mean consequences scores from pre-PTCA to post-PTCA at discharge indicated that participants perceived there to be more consequences of illness immediately following PTCA. This may have been due to participants experiencing the invasive procedure as painful, as for 82.1% of them it was their first PTCA experience, a finding inconsistent with Astin and Jones (2006) [4]. Moreover, in this study changes in mean Adherence scores were not significant. This may indicate that there is no link between perceived consequences and adherence to medications. A study which surveyed IPs (IP) of cardiac surgery candidates reported that IPs were not fully related to the real and objective medical condition or to the surgeons' rating of illness severity. Patients' views were largely different from their actual medical state [24]. This may provide an explanation for the increased consequences reported in this study, despite participants' medical condition being improved through PTCA.

Increased illness coherence from pre-PTCA to post-PTCA at 1 - 3 months revealed higher positive beliefs about participants' personal understanding of their condition. According to a review article by Kucukarslan (2012), IP dimensions, with the exception of illness coherence, influence medication adherence [25]. On the other hand, Fok *et al*. (2005), who explored the role of illness coherence on health related behavior, reported a positive correlation between sense of coherence, quality of life and coping abilities. Sense of coherence was found to determine positive health outcomes and successful coping [26]. Our findings are consistent with those of Fok *et al*. (2005).

Over the data collection time-points, changes in perception of treatment control and personal control were insignificant. This demonstrates that participants' views on the efficiency of their treatment in controlling their illness, in addition to their own ability to take control over their illness, remained unchanged. Although PTCA is a curative procedure for patients with CAD [5], Bowling *et al*. (2012) reported changes in treatment preferences of patients with CAD over 18 months; more negative attitudes towards PTCA were reported over time [20]. This may provide a further explanation for unchanged treatment control scores in this study.

A decrease in emotional representation over time demonstrated that patients were less affected emotionally by the illness than before. In a randomized controlled trial carried out by Broadbent *et al*. (2009), health behaviors such as exercising and returning to work were followed by improved consequences, emotional representation and treatment control, were increased [9].

More than half the participants in this study believed the greatest causes of their illness to be: stress, family problems and diet pre-PTCA; family problems, diet and stress post-PTCA at discharge; and diet, family problems, stress and my own behavior 1 - 3 months later. These factors are all classified as controllable [27]. The results of this study are therefore consistent with Roesch and Weiner's (2001) who carried out a meta-analysis on illness coping and its relationship to causal attribution in physically ill patients or patients undergoing medical procedures. Their meta-analysis revealed that controllable and unstable illness attributions were accompanied by positive psychological coping by using adaptive coping strategies. On the other hand, uncontrollable and stable causal attributions were associated with negative psychological adjustment by using Avoidance or maladaptive coping strategies [28].

Karademas *et al*. (2014) in their survey of cardiovascular patients revealed that personal control and illness coherence were mediators of the relationship between maladaptive health beliefs and coping behaviors [29]. Increases in identity, consequences, timeline and illness coherence in this study lead to an increased medical adherence and adaptive coping therefore our findings are consistent with these studies. While in other studies patients who perceived their illness to have a chronic or cyclical time course or to have severe consequences on their lives reported higher levels of disability, depressive symptoms, and lower levels of physical functioning after myocardial infarction. In other words IP is known as a predictor of the probability of experiencing complications [30] [31]. Conversely, Juergens *et al*. (2010) in their study which surveyed the relationship of IP and health related behavior revealed that illness beliefs were the strongest predictor of health related outcomes [24].

4. Conclusion

Although participants reported inaccuracies in treatment and personal control, which could influence outcomes and health behaviors, illness perceptions improved overall. Increased use of controllable causal attributions led

to increases in medication adherence and adaptive coping mechanisms. Participants, who were less emotionally affected by the illness, were more likely to adhere to medical recommendations and use adaptive coping strategies. Therefore, we purported that post treatment health behaviors were predictable by assessing patients' illness related beliefs in advance. Furthermore, the more realistic participants' perceptions are of their disease, the more they will adhere to medical orders.

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Declaration of Conflicting Interests

Conflict of interest: There was no conflict of interest.

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Human and Animal Rights and Informed Consent

The study conformed to the principles outlined in the Declaration of 1975 Helsinki and its later amendments and was approved by the ethics committee of Tabriz University of Medical Sciences (5/4/828). Informed consent was obtained from all individual participants included in the study.

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